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The determination of wildland suitability for various uses and their proper classification for use is becoming increasingly important to planning. This article discusses an approach to constructing suitability indices for a number of various uses while considering many different criteria important to evaluating use possibilities. A multivariate statistical technique is then utilized to develop a hierarchical suitability classification. This classification offers a tool for analyzing the sensitivity of use suitability to level of classification.

Keywords: suitability, classification, cluster analysis.

1. Introduction

The management of wildlands has become increasingly complex in recent years. There has been a marked increase in demand for renewable resources, resulting in numerous conflicts over land use. In the United States, a recent assessment projects that these demands will continue to increase in the future and management programs must be developed now to provide for long-term needs (Resource Planning Act Assessment, 1975).

A fundamental part of the future management task must involve an assessment of the wildland areas' suitability for various uses. At the same time, this assessment should provide an indication of the areas' environmental sensitivity. In selecting possible management alternatives, the proper determination of suitability or capability can play a key role in increasing productivity of wildlands. Procedures for assessing suitability or capability should have a significant impact in future management planning.

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2. Current approaches for determining suitability and for classifying wildlands

Most approaches to determining suitability have stressed one functional area. For example, suitability for timber production based on productivity uses site index as a guide. This index is traditionally based on the height of the dominant tree at a certain base age. Other approaches to calculate site index have used regression equations with various site factors as the independent variables. The determination of suitability for other uses such as forage production, water production, recreation sites and wildlife habitat have also been individually studied, resulting in numerous specialized classification schemes.

This functionalized approach has contributed to the development of suitability classifications based solely on one use, such as the standard, special and marginal commercial timber classification utilized by the USDA Forest Service. This classification is based on a number of physical factors concerning the timber and land base. Although this system considers more factors than just productivity, it is still a functionally-oriented classification and does not directly provide indications of the area's suitability for other uses.

Recently, procedures for classification have relied on an ecological approach. Habitat typing has been studied extensively (Jones, 1969). The USDA Forest Service ECOCLASS system and others (Corliss, 1974) have used both vegetation and landform to construct this type classification. Most of these systems have been developed from a subjective approach (as opposed to numerical taxonomic schemes) and have been made hierarchical to provide finer classifications as the land size becomes smaller. This type of classification enables managers to use the same overall system for various levels of planning. Although these classifications are valuable, they are oriented primarily to ecological information and sometimes delete important criteria which are not directly related to vegetation or landform. Further, most of these classifications do not directly provide an indication of suitability for specific uses. Instead, this determination is normally made subjectively by the manager.

3. Considerations in developing an approach to suitability and wildland classification

An approach to determine suitability should utilize the strengths of systems currently available and augment them to correct possible shortcomings. In developing such an approach, certain key areas would need to be addressed.

(a) *Wildland use possibilities.* Given a management area, certain use possibilities would need to be assessed. These could be broadly defined or be very specific, depending on the area size and level of management planning. These use possibilities should consider both present land use and regional needs.

(b) *Criteria necessary to assess suitability for uses.* Given a set of use possibilities, the criteria necessary to assess suitability for these uses must be identified. These criteria may involve vegetation and landform characteristics, as well as other criteria of a non-ecological nature.

(c) *Criteria importance for each use.* The criteria developed to assess use suitability will vary in importance depending on the specific use. For example, if timber site index was selected as a criterion, it may be ranked as being very important for determining timber suitability, but of little importance in determining the area's suitability for forage. These differences should be examined, for all use possibilities.

(d) *Conditions of favorability for each criteria given a specific use.* Given different uses, the conditions of favorability may vary for each criterion. For example, in considering potential for timber, the favorable conditions for the site index criterion may be only the higher indices. In considering potential for scenery, any site index may be equally favorable. Thus, each criterion may have a different set of conditions considered advantageous or adverse to each use.

(e) *Suitability classification scheme.* Given the considerations specified in (a)–(d), a classification system should be developed in accordance with the specified criteria. The classification procedure used should be objective and provide for an hierarchical classification of suitability. Multivariate statistical techniques can provide a powerful aid in developing this type of classification system.

These general considerations can help form the basis for developing a more complete approach to wildland area suitability and classification. The following section illustrates how these important aspects can be applied in a case example.

4. Suitability analysis and wildland classification—an example

These generalized considerations provide a means of developing the suitability of an area for a wide range of possible uses. To illustrate how this approach might be applied to a specific resource, the aspen in the Central Rocky Mountains of the United States is considered in an example. There are over five million acres of aspen lands within this region and they are an important regional resource, possessing a wide range of uses.

4.1. USE POSSIBILITIES FOR ASPEN

Considering the characteristics of this resource, several use possibilities exist. In the Central Rocky Mountains, aspen stands can serve as raw material for wood products, wildlife habitat, domestic livestock range, firebreaks, sources of water run-off, watershed protection, recreation sites and scenery.†

4.2. CRITERIA NECESSARY TO ASSESS SUITABILITY FOR VARIOUS USES OF ASPEN

There are a number of possible criteria which might be included to assess suitability. In selecting these criteria, care should be taken to insure that they are useful in determining the suitability of aspen for many different uses. The criteria should be based on the type of information which is readily available from existing inventories or could otherwise be easily obtained. For example, the criteria should utilize existing sources of information such as the USDA Forest Service ECOCLASS definitions. In determining criteria, care must be taken to include only those of major importance in order to keep the total number of criteria to a practical level.

Considering these factors, the criteria selected for this application included soil stability (three possibilities), vegetative type (six possibilities), stand structure (two possibilities), timber site quality (five possibilities), and scenic quality (four possibilities). The ECOCLASS definitions were used for vegetative types and soil stability conditions; Baker's (1925) site indexing scheme (I–V) was used for site index conditions; and USDA Forest Service Visual Management System (1974) was used to define the conditions for visual quality [Retention (R), Partial Retention (PR), Modification (M)]. It should be

† D. R. Betters. The Aspen, Guidelines for Decision Making. USDA Forest Service. Unpublished report on file at the Routt National Forest, Colorado, U.S.A.

noted that, although there are only five criteria, in many cases it is possible to make inferences concerning other parameters not included. For example, vegetation type can be used to estimate approximate elevation, although elevation is not a criterion *per se*.

4.3. Ranking criteria as to importance for determining suitability for each aspen use

Each of the criteria must be ranked as to importance in determining suitability for each use of aspen. To accomplish this task, several managers within the region were informally contacted to rank these criteria and specify their logic in this ranking. Although there was some disagreement as to whether one criterion was more important than the next, in general the order in Table 1 does represent the consensus opinion and separates the important criteria from those of lesser importance. The opportunity for ranking one criterion as important as another was not allowed; however, this might be done in an application if this possibility was considered appropriate.

Table 1. The ranking of criteria for determining suitability of areas for certain uses

Importance rank	Timber production	Forage production	Water yield	Scenic beauty
1	Site quality	Vegetation type	Soil stability	Scenic quality
2	Soil stability	Soil stability	Vegetation type	Vegetation type
3	Scenic quality	Scenic quality	Scenic quality	Site quality
4	Vegetation type	Site quality	Site quality	Stand structure
5	Stand structure	Stand structure	Stand structure	Soil stability

Importance rank	Recreation site	Watershed protection	Firebreaks
1	Vegetation type	Stand structure	Vegetation type
2	Soil stability	Vegetation type	Soil stability
3	Stand structure	Site quality	Scenic quality
4	Scenic quality	Scenic quality	Site quality
5	Site quality	Stand structure	Stand structure

In the case of timber production, the logic of most managers in ranking criteria followed the same pattern. Since timber use involves both biological production and harvesting, site quality and soil stability must be key considerations. Without favorable conditions in these two criteria, it becomes impossible to develop the quantity and quality of wood necessary and, once grown, to obtain access to the area and harvest the crop. Scenic quality is also important, but, independently, it doesn't prohibit site use for timber production. It does become significant in determining how an area is to be harvested. Thus, scenic quality becomes a constraint and not as important as having favorable soil stability and site quality requirements. Given the type of aspen wood products, the vegetation type itself is of lesser importance. If the timber is on a productive site, which has stable soils, and the scenic quality requirements are considered, then it is not significant whether the aspen has a grass, forb, tall forb or brush understorey. These conditions would need to be considered when selecting alternatives, but they are not as important as the others in determining suitability.

In determining a site's suitability for forage, most managers consider the vegetation type as a key factor. The understorey composition, be it grass, forbs, conifers, etc., is the primary consideration. Soil stability is also important in considering various methods of increasing forage, and it can serve as an important indicator of site potential for herbaceous production, i.e. the moderately stable and unstable areas on shales and sandstones typically have better forage production. These conditions need to be considered, as the timber site quality ranking cannot be used to consistently forecast the site's capability to produce forage. Scenic quality is also considered significant, primarily because it influences the practices which might be applied to improve forage yields.

In increasing water yields, soil stability is considered of major importance, since this would be a key factor influencing possible alternatives. Vegetation type is considered important, since it helps identify the areas where water production is greatest—the spruce-fir zone where snowpacks occur. Scenic quality again becomes a factor in determining how treatments might be applied. Timber site quality does relate somewhat to moisture, but it is not always a consistent indicator and therefore ranked lower. Stand structure is a factor in determining how the treatment is applied, but it is not as important in determining site suitability as the other criteria.

For determining suitability for scenery, obviously the key item is the scenic quality rating, i.e. whether the area is visually sensitive to changes in the landscape. These are the retention and partial retention zones, as specified by the USDA Forest Service. Also of importance is the vegetation type, the pure aspen stands having the potential to remain in the landscape; those mixed with conifers will likely success to conifers. Further, the pure aspen provides more of the desired landscape variety. Site quality is important to a degree, in that the better sites provide a more vigorous, healthy stand. Neither the conifer-aspen stand structure nor the soil stability have significant influence on the site's suitability for scenery.

Watershed protection rankings really are not suitability-for-use rankings, but, rather, rankings for need. Soil stability is of course a key criterion for determining need for protection. Any site with unstable soils requires watershed protection, and all sites demonstrating this condition rank high in this category, regardless of other criteria. Thus, this particular use or need had only one criterion that applied realistically. The other criteria are listed, but any condition is equally favorable.

Firebreak rankings are again a combination of need and suitability. Pure aspen stands are best suited as firebreaks, and vegetation type is ranked first. Soil stability is also listed high, because it provides an indication of need, i.e. the more unstable the area, the greater the impact a fire would have on the possibility of erosion. These unstable areas would need this protection even more. Scenic quality is listed, as it provides an indication of the susceptibility of an area to fire. The areas near roads or easily accessed would be more likely to have fires occur. Of course, there are a number of other considerations concerning firebreaks—proximity of conifers, resorts, etc. In determining needs, as with other uses, further criteria might need to be considered.

In determining suitability for use as recreation sites, vegetation type is listed first. Thus, because most managers consider pure aspen to be a poor recreation site, aspen normally deteriorates rapidly under these type conditions. The soil stability is important because of user impact on that site. Stand structure is important in that only mature conifer-aspen stands are really acceptable. The scenic quality and site quality are important only in that, in the first case, it indicates the site would be in a scenic zone, and, in the second, a good timber site. Neither of these are as important as the other three in determining suitability.

TABLE 2. Conditions of favorability for each use

Use	Criteria									
	Soil stability		Timber site quality		Scenic quality		Vegetation type		Aspen/conifer stand structure	
	F†	UNF†	F	UNF	F	UNF	F	UNF	F	UNF
Timber	C-Stable B-Mod. Stable	A-Unstable	I–II	III–V	M–MM	PR	Aspen w/under-storey	Aspen Mixed conifer	Undiff.	
Water yield	C-Stable B-Mod. Stable	A-Unstable	I–II	III–V	M–MM	PR	Spruce-fir Aspen	Others	Undiff.	
Forage	C-Stable B-Mod. Stable	A-Unstable	Undiff.		M–MM	PR	Aspen w/ forage understorey	Others	Undiff. understorey	
Scenic quality	Undiff‡		Undiff.		PR	M–MM	Aspen w/ understorey	Others	Undiff.	
Rec. site	C-Stable B-Mod. Stable	A-Unstable	Undiff.		PR	M–MM	Aspen Spruce-fir Aspen Lodgepole	Others	Aspen mixed with mature conifers overstorey	Others
Watershed protection	C-Unstable	C-Stable B-Mod Stable	Undiff.		Undiff.		Undiff.		Undiff.	
Firebreaks	A-Unstable B-Mod. Stable	C-Stable	Undiff.		PR	M–MM	Aspen w/ understorey	Others	Undiff.	

† F, favourable; UNF, unfavorable.

‡ Undiff., undifferentiated means any conditions are equally favorable.

In most cases, the criteria selected applied in determining use suitability for a number of uses. In this application, the process of logically ranking criterion as to importance to use proved to be a significant exercise in itself. It provided a means of formulating, in the manager's mind, what is important to determining use suitability.

4.4. CONDITIONS OF FAVORABILITY FOR EACH OF THE CRITERIA GIVEN A SPECIFIC ASPEN USE

The conditions of favorability-unfavorability by use for each of the criterion are outlined in Table 2. Here again, managers were consulted for their opinions, as well as pertinent literature concerning the aspen resource. The favorable conditions in a criterion reflect what would be best for that particular use.

In this example, a quantitative system was developed to facilitate application of the information. A numerical rating system was constructed to weight the criterion. Table 3 indicates the linear scale to be used in this example.

TABLE 3. Scale for importance ranks for criterion

Importance rank	Scale weight
1	4 Very high
2	3 High
3	2 Medium
4	1 Low
5	0 Very low

To complete a numerical rating system, favorable or undifferentiated (that is one condition is as favorable as another) conditions are coded 1 and unfavorable conditions are coded 0. Thus, using Tables 1 through 3, a numerical rating of suitability for the various uses could be derived for any set of conditions.

For example consider an area with a stable soil, aspen forb/grass, timber site index I and modification visual zoning. For timber use, the rating would be calculated as:

	Scale wt	Fav. or undiff.	Unfav.	Total
Site quality	4	1		4
Soils	3	1		3
Scenic quality	2	1		2
Veg. type	1	1		1
Stand structure	0	1		0
				10

Given this numerical rating system, 10 is the highest rating for suitability. Using Tables 1 through 3, ratings for other uses could be calculated in a similar manner: scenery use 7, water yield 7, forage use 10, recreation site use 3, watershed protection need 6, and firebreak use 5. A numerical rating of 8 or greater was considered necessary in order for an area to be highly suited for a given use. Given the importance of criteria and their conditions of favorability, this area was found to be highly suited for timber and forage uses, and more highly suited for these uses than some of the others. If we consider that the potential of the site is important in selecting management alternatives, this rating provides part of the basis for determining a management scheme for these type areas.

As indicated by Table 3, a linear scale was used in developing the numerical rating. This scale could have been non-linear if the survey of the managers pointed strongly to a non-proportionate difference in criteria importance. However, rather than changing the scale, an indirect means can be utilized to express this aspect of the managers' rankings. For example, in the case of watershed protection, any site demonstrating unstable soils was considered in need of watershed protection. Each of the remaining four criteria are of equal importance, with all conditions of each criteria being considered in need of watershed protection. Therefore, only suitability values of 10 and 6 can occur.

In cases where the criteria were linearly ranked such as in determining timber suitability, a rating greater than or equal to eight was set to identify highly suitable sites. This identification reflects the proportionality in ranking using the linear scale and requires the first two criteria and one of the next two to have favorable conditions in order for the site to be ranked as highly suitable. The lower the overall score, the less suitable the site is for a certain use. This aspect will be explored in more detail in the next section, where the numerical rating scheme is combined with a classification technique.

4.5. DEVELOPING A SUITABILITY CLASSIFICATION SCHEME FOR ASPEN

Given the system for determining suitability, the next phase in applying the approach to an area would involve developing a suitability classification scheme. In this case, cluster analysis was used to construct the suitability classification and examine relationships. Cluster analysis is a multivariate statistical technique that classifies objects by placing them in homogeneous groups in a manner that reveals the relationships between these groups (Davis, 1973).

The general similarity coefficient of Gower (Gower, 1971) was chosen to compute the similarity coefficient existing between clusters. Gower's Similarity Coefficient is defined as

$$S_G = \frac{\sum_{i=1}^{n} W_{ijk} S_{ijk}}{\sum W_{ijk}}$$

where, S_{ijk} is a value less than or equal to one and greater than or equal to zero, and represents the similarity of plot j and k for character i. W_{ijk} is the assigned weight for character i. In this application, four criteria were weighted greater than one. Soil stability and vegetation type were weighted the heaviest, since these criteria are either ranked the most or second most important in six of the seven land uses. Site quality and scenic quality are lightly weighted, since both are the most important criterion in only one land use.

The clustering strategy employed here is the unweighted, pair-group method, using arithmetic averages. In this form of clustering, the inner cluster distance is taken as the average of the N_i, N_j interplot distances. The distance from cluster k to the union of clusters i and j (D_{kij}) can be expressed by the following equation:

$$D_{kij} = (N_i D_{ik} + N_j D_{jk})/(N_i + N_j).$$

An agglomerative hierarchical program, HYRARK, was used to compute the inter cluster differences†.

To illustrate how the rating system might be combined with cluster analysis, a specific case study area was selected within the Bears Ears Planning Unit of the Routt National Forest of Colorado. The area examined comprises approximately five and one-half kilometers in the southeastern portion of the Bears Ears Planning Unit (sections 14, 15, 16 and the north one-half of 22). This area is predominantly aspen forest.

Sixty sites were systematically sampled throughout the study area. Data concerning the criteria site quality, soil stability, scenic quality, vegetation types, and stand structure were collected for each site. Cluster analysis was then used to examine the relationship present between the sixty plots for which the data were collected. The vertical axis of the dendrogram (Figure 1) represents the similarity level at which the plots cluster. The horizontal axis is only used for separating the various plots being considered for clustering.

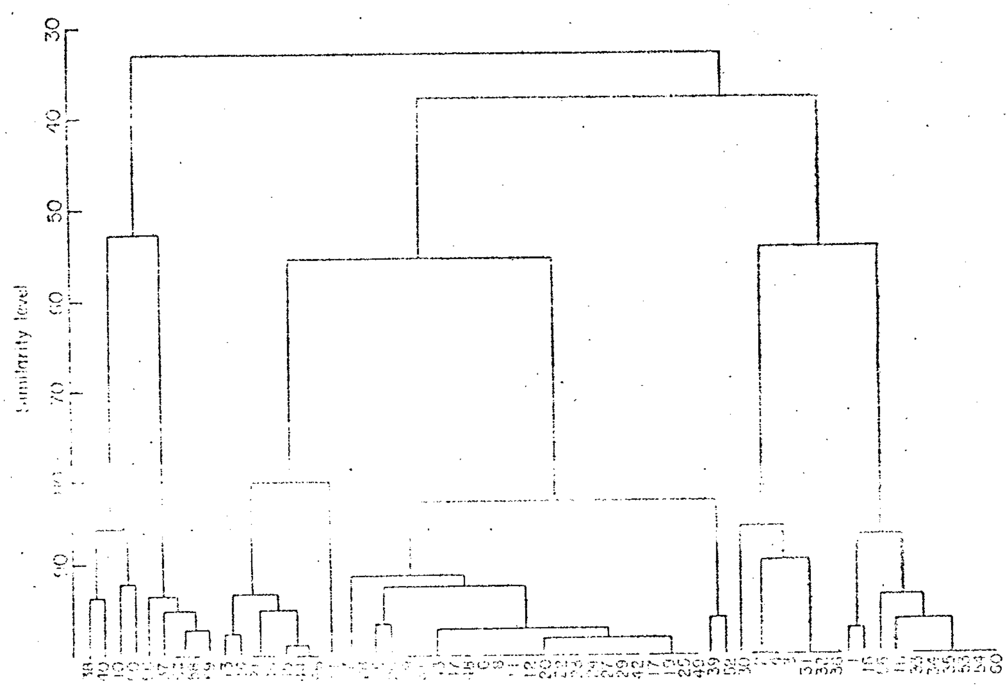

Figure 1. Dendrogram showing clusters of sites at various levels of similarity

The determination of the similarity level chosen to designate the number of clusters to be examined depends primarily on how the suitability classification is to be used. If highly detailed planning is the objective of the analysis, a high degree of similarity between clusters must exist. If the dendrogram is examined at the 90% similarity level, twelve different clusters or land types (*a* through *l*) are indicated. Each cluster at this degree of similarity was found to contain sites highly suited (a numerical rating of eight or higher) for particular combinations of the seven land uses considered. A map depicting the distribution of these land types throughout the study area is shown in Figure 2.

† Fortran program on file at Colorado State University.

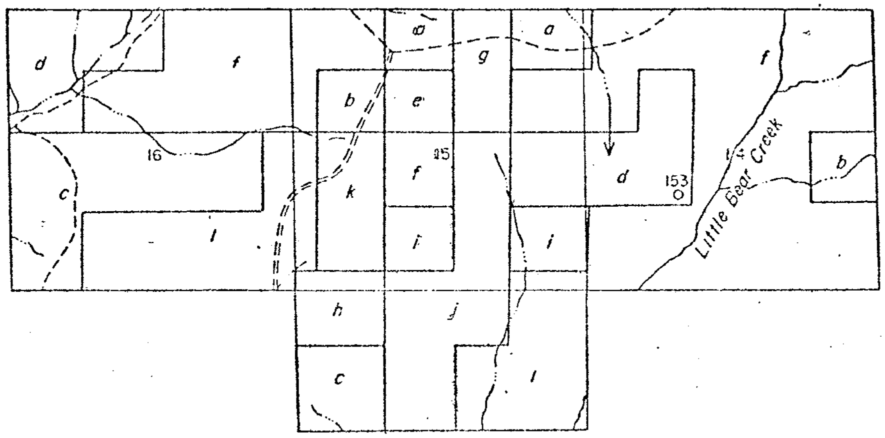

Figure 2. Twelve land types are present at the 90% similarity level.

One of the chief advantages of this approach is that land can be objectively classified at any level, ranging from detailed to broad land types. Therefore, considering suitability, small scale unit planning can occur by choosing land types with a high degree of similarity

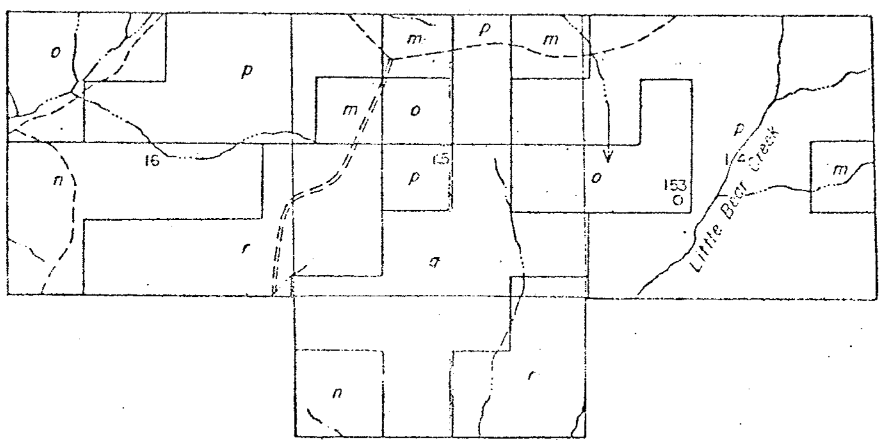

Figure 3. Six land types are present at the 70% similarity level.

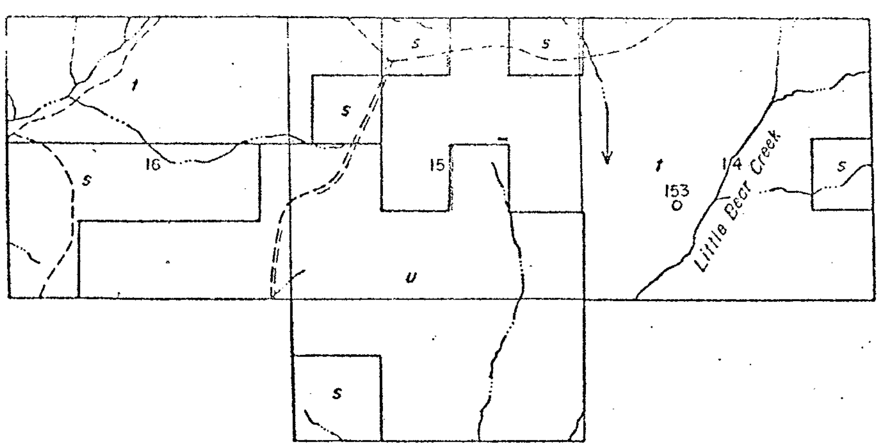

Figure 4. Three land types present at the 50% similarity level.

within them. By choosing a lower similarity level, the homogeneity within land types decreases, as does the number of land types the land manager must consider (as shown in Figures 3 and 4).

Here homogeneity within the land types at these lower similarity levels has now decreased such that different land uses are now present within sub-areas of the same land type. The total variation within the suitability rankings at each clustering step therefore increases as similarity decreases. This is shown in Figure 5, where the trace, the sum of the elements of the principal diagonal of the variance-covariance matrix, is shown at the 90, 70 and 50% similarity levels. The trace value is thus equal to the summation of the variation of each of the seven land uses at the three similarity levels investigated.

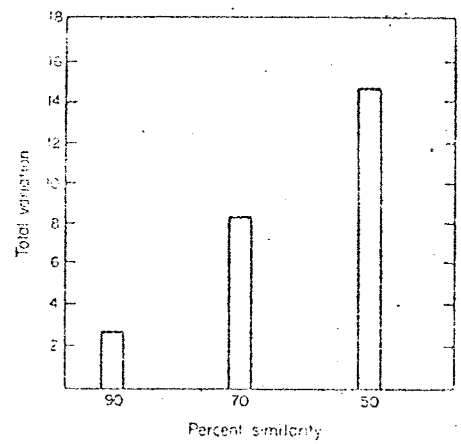

Figure 5. Total variation present at various similarity levels.

Figure 6 shows how the range of suitability values increases as the similarity between clusters and the number of land types present decreases.

This type information provides an indication of what level of classification the manager should use for planning in this management unit. Based on the sample and procedures outlined here, a system of twelve land types for aspen would be required for detailed planning. A smaller number of land types might be used for broad-scale planning, but the increasing variation allows for some amount of diversity in suitability as indicated by Figures 5 and 6. The cluster routine applied here provides valuable information in objectively analyzing this situation.

5. Discussion and conclusions

The approach outlined forms part of the basis for determining the suitability of an area for a number of uses. It provides the manager with guides for making multiple use management decisions. Land use plans typically have certain use objectives based on policy and regional and national needs. This procedure provides a straightforward methodology for identifying areas which have the greatest potential or are most suitable for meeting those objectives. Alternatives could be selected, using suitability as a partial guide for determining management direction. Considering the economics involved and that a limited budget most often exists, it makes sense to invest where the largest benefits are derived from the costs. Investment on areas having the most potential follows these general economic guides.

Land types: Percent similarity 50	70	90	Site	Land use suitability ratings: Timber	Forage	Water yield	Scenic beauty	Recreation site	Watershed protection	Firebreak
s	m	a	38	4	1	4	7	7	10	6
			40	4	1	4	7	7	10	6
		b	10	6	3	6	3	6	10	4
			50	2	3	5	3	6	10	4
	n	c	56	9	6	10	3	9	6	1
			37	9	6	10	3	9	6	1
			57	9	6	10	3	9	6	1
			58	9	6	10	3	9	6	1
			59	9	6	10	3	9	6	1
t	o	d	13	2	3	2	6	2	10	9
			14	2	3	2	6	2	10	9
			21	6	3	2	6	2	10	9
			45	6	3	3	6	2	10	9
			15	6	3	3	6	2	10	9
			44	2	3	2	6	2	10	9
			46	2	3	2	6	2	10	9
		e	51	6	10	6	6	5	6	5
	p	f	7	3	7	2	6	2	10	8
			28	3	7	2	6	2	10	8
			5	3	7	2	6	2	10	8
			26	3	7	2	6	2	10	8
			9	7	7	3	6	2	10	8
			41	7	7	3	6	2	10	8
			43	7	7	3	6	2	10	8
			47	7	7	3	6	2	10	8
			48	7	7	3	6	2	10	8
			6	7	7	3	6	2	10	8
			8	7	7	3	6	2	10	8
			11	7	7	3	6	2	10	8
			12	7	7	3	6	2	10	8
			20	7	7	3	6	2	10	8
			22	7	7	3	6	2	10	8
			23	7	7	3	6	2	10	8
			24	7	7	3	6	2	10	8
			27	7	7	3	6	2	10	8
			29	7	7	3	6	2	10	8
			42	7	7	3	6	2	10	8
			17	3	7	3	6	2	10	8
			19	3	7	3	6	2	10	8
			25	3	7	3	6	2	10	8
			49	3	7	3	6	2	10	8
		g	39	5	5	1	10	3	10	10
			52	1	5	0	10	3	10	10
u	q	h	30	[illegible]	4	7	10	6	6	7
		i	2	10	6	7	[illegible]	5	6	5
			4	10	6	7	6	5	5	5
		j	3	6	6	6	6	5	6	5
			31	6	6	6	6	5	6	5
			32	6	6	6	6	5	6	5
			36	6	6	6	6	5	6	5
	r	k	1	4	8	10	10	6	6	7
			18	4	8	10	10	6	6	7
		l	55	6	10	6	6	5	5	5
			16	5	10	6	6	5	6	5
			33	6	10	6	6	5	6	5
			34	6	10	6	6	5	6	5
			35	6	10	6	6	5	6	5
			53	6	10	6	6	5	6	5
			54	6	10	6	6	5	6	5
			50	6	10	6	6	5	6	5

Figure 6. Range of suitability values at 90, 70 and 50% similarity levels.

The method furnishes a means of determining which areas possess certain dominant use characteristics, as well as those areas that exhibit multiple-use potential. In this example, land type *l* was highly suited only for forage, while land type *c* was highly suited for timber-water yields and recreation sites. Further, given the various uses, the process describes the areas which would be likely to have conflicts over use direction and those which would have complementary uses. For example, land type *g* is highly suited for scenery-watershed protection-firebreaks which are quite compatible. The method also provides a means of analyzing the relationship between hierarchical classification and the degree of suitability for various land uses. The higher the similarity level, the finer the classification and thus the ratings for a particular use have less variability within the classification. This relationship allows for a clearer definition of the suitability and potential of the area and helps to identify the complementary-non-complementary relationships more precisely. As the degree of similarity becomes less and the classification broader, the suitability for a particular use may have a range of values. This variability could be quite broad or rather small, depending on how the clusters or land types are combined. The level of suitability for a use could therefore remain in a range of high suitability or from very high to very low. For example, the combining of land types *a* and *b* into land type *n* results in little change in suitability, whereas combining *d* and *e* into land type *o* creates a wide range in suitabilities. This level of classification has the land type both requiring and not requiring watershed protection and the forage suitability rating ranges from as high as 10 to as low as three. This information becomes useful in identifying the uses to which the area is clearly highly suited or unsuited and those uses which are not well defined. Thus, the procedure aids in pointing out where these conditions would exist, given the use of a certain level of classification. If the variability was quite large, and the planning process required more definitive estimates of suitability, possibly a finer level of classification should then be used.

In this example, only a few uses and criteria were developed, but the approach could apply to any set of uses and any number of criteria. Of course, the larger the number of uses and criteria, the more complex the suitability and classification system. Possibly a computerized system would be appropriate in that case. Although the system complexity increases, the consideration of all criteria simultaneously is a strong point in the approach. The suitability of a site is determined by assessing numerous criteria simultaneously. It is the sum total of all the favorable and unfavorable conditions that identify suitability. It should be noted that one of the most difficult tasks is determining what criteria to use. If possible, criteria selected ought to be useful in determining suitability for a number of uses. However, at times, this may not be possible and a use may have a criterion which would apply only to that use and not be significant in determining suitability for other uses.

The step-by-step process itself has merit in that it requires the formulation of the possible uses for an area, what is important to determining suitability for use, and what criteria conditions are most favorable. It helps to define in the manager's mind what level of classification is necessary for multi-use planning. This planning process is in itself extremely beneficial in more clearly defining the management problem. The fundamental procedure seems appropriate to any scale of decision making—area or regional plans and more detailed unit plans.

The use of the approach provides only a partial basis for management decision making. The information provided here must be linked to overall goals, demands and management constraints concerning the area in question. The procedure and techniques discussed here thus provide only a portion of the necessary input to the decision making process. However, it is a significant input, since, in the future, there will be a need for an in-depth analysis of the land's suitability for various levels of decision making. The approach described here has possibilities for use in meeting this task.

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